

(12) UK Patent Application (19) GB (11) 2 323 769 (13) A

(43) Date of A Publication 07.10.1998

(21) Application No 9706828.2

(22) Date of Filing 04.04.1997

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(51) INT CL⁶
B60R 22/18 // B60R 22/46

(52) UK CL (Edition P)
B7B BVRP

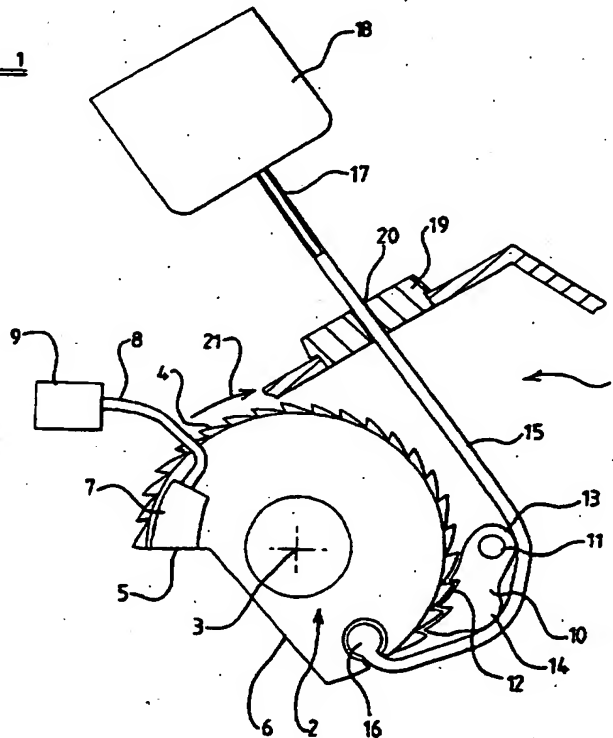
(56) Documents Cited
GB 2294866 A GB 2268044 A EP 0662408 A1

(58) Field of Search
UK CL (Edition O) A3V VRP
INT CL⁶ B60R 22/18 22/46
Online: WPI

(54) Abstract Title
Seat belt pretensioner

(57) A vehicle seat belt pretensioner (1) comprising a rotatable ratchet element (2) having peripheral ratchet teeth, a movably mounted pawl (10) adapted to engage the ratchet teeth, a gas generator (7) mounted on the ratchet element (2) arranged to eject gas to effect rotation of the element (2), and an elongate flexible means (15) extending from the ratchet element (2) to means adapted to engage or receive part of a seat belt (18). The arrangement is such that rotation of the ratchet element (2) in response to activation of the generator (7) applies tension to the elongate flexible means (15) to apply tension to the seat belt and to bias the pawl (10) into engagement with the ratchet element (2).

FIG 1



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FIG 1

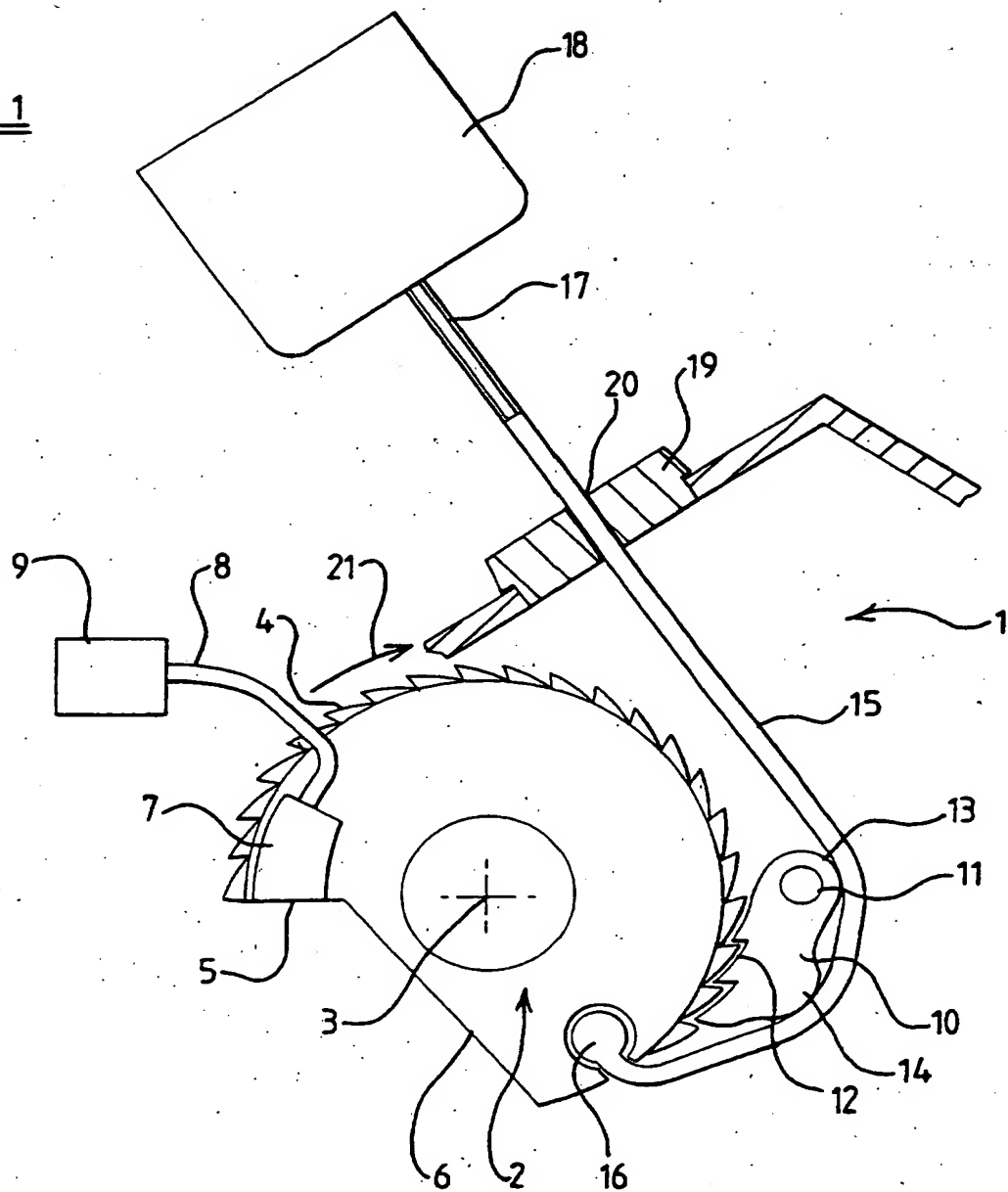
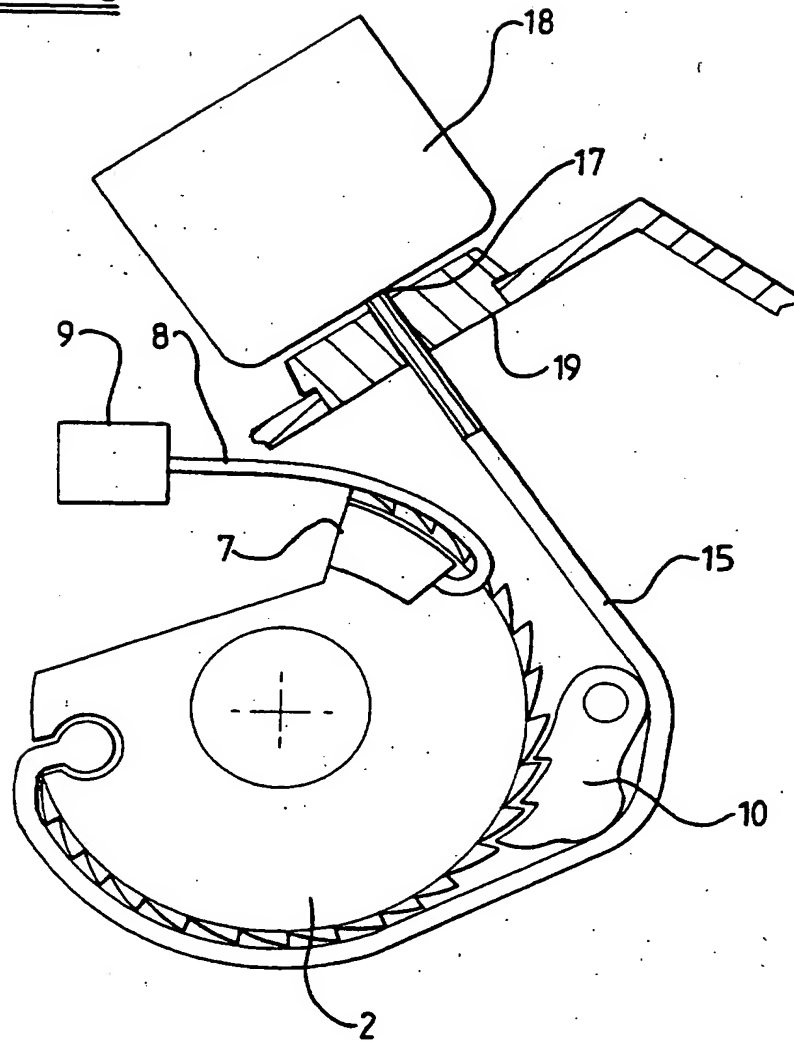


FIG 2



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PATENTS ACT 1977

Agents Ref: P11274GB-NHF/WA/jk

**"IMPROVEMENTS IN OR RELATING TO A VEHICLE SEAT BELT
PRETENSIONER"**

THE PRESENT INVENTION relates to a vehicle seat belt pretensioner.

A typical vehicle, such as a motor car is provided with seat belts which may be fastened around the occupants of the vehicle. Should the vehicle be involved in an accident in which the vehicle decelerates rapidly the inertia of an occupant in the vehicle results in the occupant continuing in a forward direction relative to the vehicle. Seat belts are provided in a typical vehicle so that an occupant wearing such a seat belt is restrained in his seat and does not move in a forward direction relative to the vehicle during rapid deceleration.

It is usual for the above described seat belts to be of the retractable kind so that, when the seat belt is unfastened, it is retracted around a spool mounted in a housing attached to the vehicle. It is common for such a vehicle seat belt to be provided with means to lock the

belt is prevented from being pulled out from the retractor when an occupant moves forward during rapid deceleration of the vehicle.

It is desirable to take up any slack in a vehicle seat belt to minimise the distance by which an occupant may move forward when a vehicle decelerates rapidly. Thus some cars nowadays are provided with seat belt pretensioners which, in response to rapid deceleration of the vehicle, tension a seat belt about an occupant to take up any slack in the belt system so that the distance by which an occupant may move forward is reduced.

Such a seat belt pretensioner is disclosed in European Patent Publication No. 662408A. This document discloses a pretensioner having a cable, one end of which is attached to the buckle of a seat belt. The other end of the cable is attached to a ratchet wheel. The ratchet wheel is rotated in one direction by a piston in response to the detection of an accident. The rotation of the wheel applies tension to the cable, thereby also applying tension to the seat belt. Rotation of the ratchet wheel in the opposite direction is prevented by a spring biased pawl.

The problem with this type of seat belt pretensioner is that it comprises many components and is rather bulky.

According to this invention there is provided a vehicle seat belt pretensioner comprising a rotatable ratchet element having peripheral ratchet teeth, a movably mounted pawl adapted to engage said teeth, a gas generator mounted on said element and elongate flexible means extending from said rotatable element past said ratchet to means adapted to engage or receive part of a seat belt, the arrangement being such that rotation of said ratchet element in response to activation of the gas generator

applies tension to the elongate flexible means to move said means to engage said seat belt and to cause the elongate flexible means to engage the pawl and bias the pawl into engagement with the ratchet element.

Conveniently the pawl is elongate, and is pivotally mounted at one end, one edge of said pawl having means adapted to engage with the teeth on said ratchet wheel.

Preferably a rounded protrusion is provided on said pawl on the edge opposite the edge having means adapted to engage said ratchet wheel teeth and remote from the pivot mounting.

Advantageously the elongate flexible means is looped about said pawl so that the portion of the elongate flexible means extending from said rotatable ratchet element to said one end of the pawl follows a substantially V-shaped path.

Conveniently the said ratchet element has an arcuate edge provided with said ratchet teeth, one end of said arcuate edge being adjacent to a radially inwardly extending edge, said gas generator being mounted on the ratchet element such that when gas is expelled from the gas generator the gas stream flows substantially perpendicularly to the radial edge.

Preferably said means adapted to engage or receive part of a seat belt is a seat belt buckle.

Advantageously said elongate flexible means is a cable.

Conveniently a restrictor is provided, mounted on housing surrounding said pretensioner, between the pawl and said means adapted to engage or received part of a seat belt, there being a bore extending through said restrictor of substantially identical diameter as said elongate flexible means, the elongate flexible means passing through said bore.

Preferably the said restrictor is made from a rubber or plastics material.

Advantageously said gas generator is activated in response to a signal from means to detect an accident.

Conveniently said means to detect an accident is a deceleration detector.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which :

FIGURE 1 is a cross-sectional view of a vehicle seat belt pretensioner according to the present invention in a first state; and

FIGURE 2 is a cross-sectional view corresponding to Figure 1 illustrating the vehicle seat belt pretensioner in a second state.

Referring initially to figure 1, the vehicle seat belt pretensioner 1 comprises a ratchet wheel 2 which is rotatably mounted on a central axis 3. The ratchet wheel 2 is substantially circular but has a portion removed from

19. If any downward force is applied to the seat belt buckle 18, the friction of the cable 15 on the walls of the bore 20 causes the length of cable 15 above the restrictor 19 to buckle rather than pushing the cable 15 through the bore 20. Therefore it is not possible to push any of the cable 15 downwardly through the restrictor 19. Thus the ratchet wheel 2 remains in the position illustrated in Figure 1.

Should the vehicle be involved in an accident, the accident detecting means 9 sends a signal via the wire 8 to the gas generator 7. The gas generator 7 is then activated and expels gas outwardly via its exit perpendicularly to the radial edge 5 of the ratchet wheel 2. The reaction resulting from the expulsion of gas causes the ratchet wheel 2 to rotate in the direction of the arrow 21. This rotation winds the cable 15 about the ratchet wheel 2, applying tension to the cable 15 which moves the seat belt fastener 18 downwardly until it reaches the top of the restrictor 19, as shown in Figure 2. As the cable 15 is being wound about the ratchet wheel 2 the engaging edge 12 of the pawl 10 slides over the sloping edges of the ratchet teeth on the arcuate edge 4 so that rotation of the ratchet wheel 2 is not impeded. However, rotation in the opposite direction (i.e. opposite the direction of the arrow 21) is prevented by the engaging edge 12 of the pawl 10 locking on the radially outwardly facing edges of the ratchet teeth 4. The tension on the cable 15 causes the cable 15 to engage the pawl 10 and bias the free end of the pawl 10 into engagement with the ratchet wheel. Thus the cable 15 prevents the pawl 10 from swinging outwardly and also prevents the ratchet wheel 2 from rotating in the reverse direction. The pawl 10 does not need a spring to bias it into contact with the ratchet wheel as this function is performed by the cable 15 when it is tensioned.

If a seat belt is fastened in the buckle 18 during winding up of the cable 15 then the movement of the buckle 18 causes the seat belt to be pulled downwards and substantially tensioned. Upward movement of the buckle 18, which would lead to slackening of the seat belt, is prevented by the locking of the pawl 10 on the ratchet wheel 2.

It is to be appreciated that in another embodiment of the invention the pivotally mounted pawl could be replaced with a pawl mounted to move linearly.

CLAIMS

1. A vehicle seat belt pretensioner comprising a rotatable ratchet element having peripheral ratchet teeth, a movably mounted pawl adapted to engage said teeth, a gas generator mounted on said element arranged to eject gas to effect rotation of said element and elongate flexible means extending from said rotatable element past said ratchet to means adapted to engage or receive part of a seat belt, the arrangement being such that rotation of said ratchet element in response to activation of the gas generator applies tension to the elongate flexible means to move said means adapted to engage said seat belt and to cause the elongate flexible means to engage the pawl and bias the pawl into engagement with the ratchet element.
2. A vehicle seat belt pretensioner according to claim 1 wherein the pawl is elongate, and is pivotally mounted at one end, one edge of said pawl having means adapted to engage with the teeth on said ratchet wheel.
3. A vehicle seat belt pretensioner according to claim 2 wherein a rounded protrusion is provided on said pawl on the edge opposite the edge having said means adapted to engage said ratchet wheel teeth and remote from the pivot mounting.
4. A vehicle seat belt pretensioner according to claim 3 wherein the elongate flexible means is looped about said pawl so that the portion of the elongate flexible means extending from said rotatable ratchet element to said one end of the pawl follows a substantially V-shaped path.
5. A vehicle seat belt pretensioner according to any one of the preceding claims wherein the said ratchet

element has an arcuate edge provided with said ratchet teeth, one end of said arcuate edge being adjacent a radially inwardly extending edge, said gas generator being mounted on the ratchet element such that when gas is expelled from the gas generator the gas stream flows substantially perpendicularly to the radial edge.

6. A vehicle seat belt pretensioner according to any one of the preceding claims wherein said means adapted to engage or receive part of a seat belt is a seat belt buckle.

7. A vehicle seat belt pretensioner according to any one of the preceding claims wherein said elongate flexible means is a cable.

8. A vehicle seat belt pretensioner according to any one of the preceding claims wherein a restrictor is provided, mounted on housing surrounding said pretensioner, between the pawl and said means adapted to engage or receive part of a seat belt, there being a bore extending through said restrictor of substantially identical diameter as said elongate flexible means, the elongate flexible means passing through said bore.

9. A vehicle seat belt pretensioner according to claim 8 wherein the said restrictor is made from a rubber or plastics material.

10. A vehicle seat belt pretensioner according to any one of the preceding claims wherein said gas generator is activated in response to a signal from means to detect an accident.

11. A vehicle seat belt pretensioner according to claim 10 wherein said means to detect an accident is a deceleration detector.

12. A vehicle seat belt pretensioner substantially as herein described with reference to and as showing in figures 1 and 2.

13. Any novel feature or combination of features disclosed herein.



Application No: GB 9706828.2
Claims searched: 1 - 12

Examiner: Justin Black
Date of search: 13 June 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.O): A3V (VRP)

Int CI (Ed.6): B60R 22/18, 22/46

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2294866 A (NHK). See whole document.	
A	GB 2268044 A (TAKATA). See whole document.	
A	EP 0662408 A1 (TOKAI-). See whole document.	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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